String Data Type and Operations

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Objectives

- To introduce objects and instance methods (**§**4.4).
- To represent strings using the **String** objects (§4.4).
- To return the string length using the **length()** method (§4.4.1).
- To return a character in the string using the **charAt(i)** method (§4.4.2).
- To use the **+** operator to concatenate strings (§4.4.3).
- To read strings from the console (§4.4.4).
- To read a character from the console (§4.4.5).
- To compare strings using the **equals** method and the **compareTo** methods (§4.4.6).
- To obtain substrings (§4.4.7).
- To find a character or a substring in a string using the **indexOf** method (§4.4.8).

Outline

- Discussed
    - The char data type and The Character class
- The String data type
    - String class, objects, and invoking the instance methods
    - Simple (important) methods and operations of String objects
        - Getting the length, getting a character
        - Concatenating strings
        - Reading strings, characters from the console
        - Comparing strings using the equals and compareTo methods
        - Obtaining substrings
        - Finding a character or a substring

The String Data Type

- The char type only represents one character. To represent a string of characters, use the data type called String.
- Example
    - String message = "Welcome to Java";

The String Class

- String is actually a predefined class in the Java library just like the System class and Scanner class.
- The String type is not a primitive type. It is known as a *reference type*.
- Any Java class can be used as a reference type for a variable.
- For the time being, you just need to know
  - how to declare a String variable,
  - how to assign a string to the variable,
  - how to concatenate strings, and
  - how to perform simple operations for strings.

Simple Methods for **String** Objects

Method	**Description**
`length()`	Returns the number of characters in this string.
`charAt(index)`	Returns the character at the specified index from this string.
`concat(s1)`	Returns a new string that concatenates this string with string s1.
`toUpperCase()`	Returns a new string with all letters in uppercase.
`toLowerCase()`	Returns a new string with all letters in lowercase.
`trim()`	Returns a new string with whitespace characters trimmed on both sides.

Remark: Simple Methods for **String** Objects

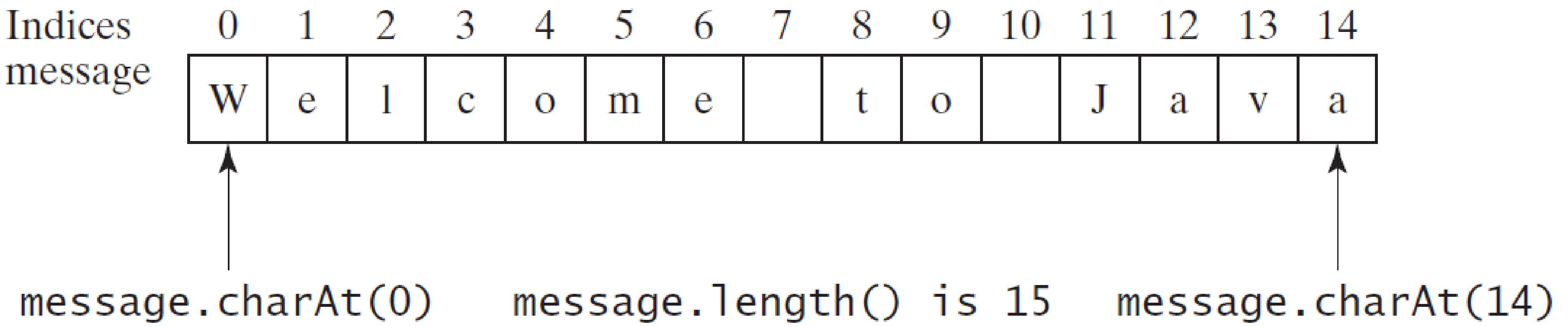
- Strings are **objects** in Java.
- The methods in the preceding table can only be invoked from a specific string object/instance.
- For this reason, these methods are called *instance methods*.
- A non-instance method is called a *static method*.
- A static method can be invoked without using an object.
- All the methods defined in the **Math** class are static methods.
- They are not tied to a specific object instance. The syntax to invoke an instance method is
    - **referenceVariable.methodName(arguments)**

Getting String Length

```
String message = "Welcome to Java";

System.out.println("The length of " + message + " is
   " + message.length());
```

Getting Characters from a String



```
String message = "Welcome to Java";
System.out.println("The first character in message is "
   + message.charAt(0));
```

Converting Strings

- Examples

  "Welcome".toLowerCase() returns a new string, welcome.

  "Welcome".toUpperCase() returns a new string, WELCOME.

  " Welcome ".trim() returns a new string, Welcome.

String Concatenation

- Examples

```
String s3 = s1.concat(s2); or String s3 = s1 + s2;

// Three strings are concatenated
String message = "Welcome " + "to " + "Java";

// String Chapter is concatenated with number 2
String s = "Chapter" + 2; // s becomes Chapter2

// String Supplement is concatenated with character B
String s1 = "Supplement" + 'B'; // s1 becomes SupplementB
```

Reading Strings from the Console

- Examples

```
Scanner input = new Scanner(System.in);
System.out.print("Enter three words separated by spaces: ");
String s1 = input.next();
String s2 = input.next();
String s3 = input.next();
System.out.println("s1 is " + s1);
System.out.println("s2 is " + s2);
System.out.println("s3 is " + s3);
```

Reading a Character from the Console

- Examples

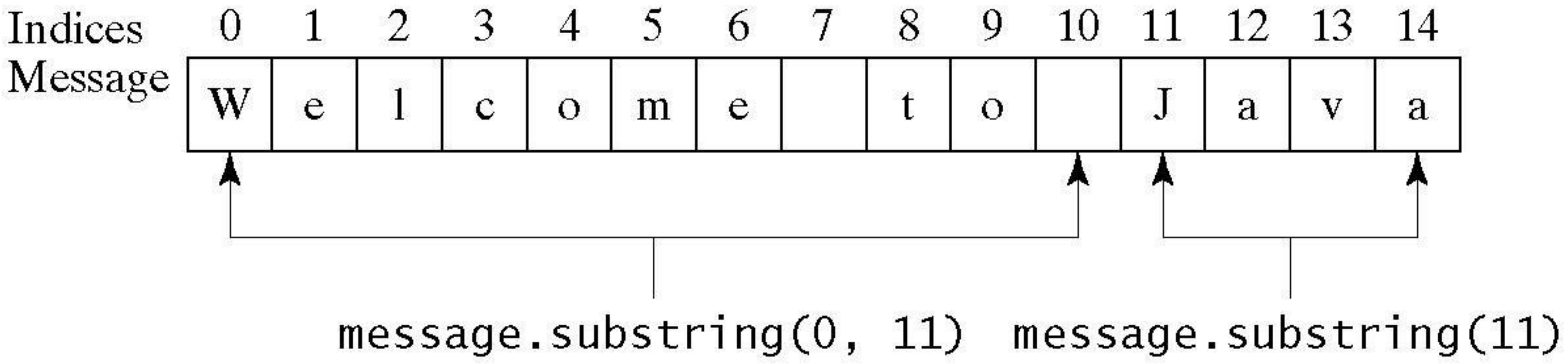
```
Scanner input = new Scanner(System.in);
System.out.print("Enter a character: ");
String s = input.nextLine();
char ch = s.charAt(0);
System.out.println("The character entered is " + ch);
```

Compare Strings

Method	Description
`equals(s1)`	Returns true if this string is equal to string `s1`.
`equalsIgnoreCase(s1)`	Returns true if this string is equal to string `s1`; it is case insensitive.
`compareTo(s1)`	Returns an integer greater than `0`, equal to `0`, or less than `0` to indicate whether this string is greater than, equal to, or less than `s1`.
`compareToIgnoreCase(s1)`	Same as `compareTo` except that the comparison is case insensitive.
`startsWith(prefix)`	Returns true if this string starts with the specified prefix.
`endsWith(suffix)`	Returns true if this string ends with the specified suffix.

Obtaining Substrings

Method	Description
`substring(beginIndex)`	Returns this string's substring that begins with the character at the specified `beginIndex` and extends to the end of the string, as shown in Figure 4.2.
`substring(beginIndex, endIndex)`	Returns this string's substring that begins at the specified `beginIndex` and extends to the character at index `endIndex – 1`, as shown in Figure 9.6. Note that the character at `endIndex` is not part of the substring.

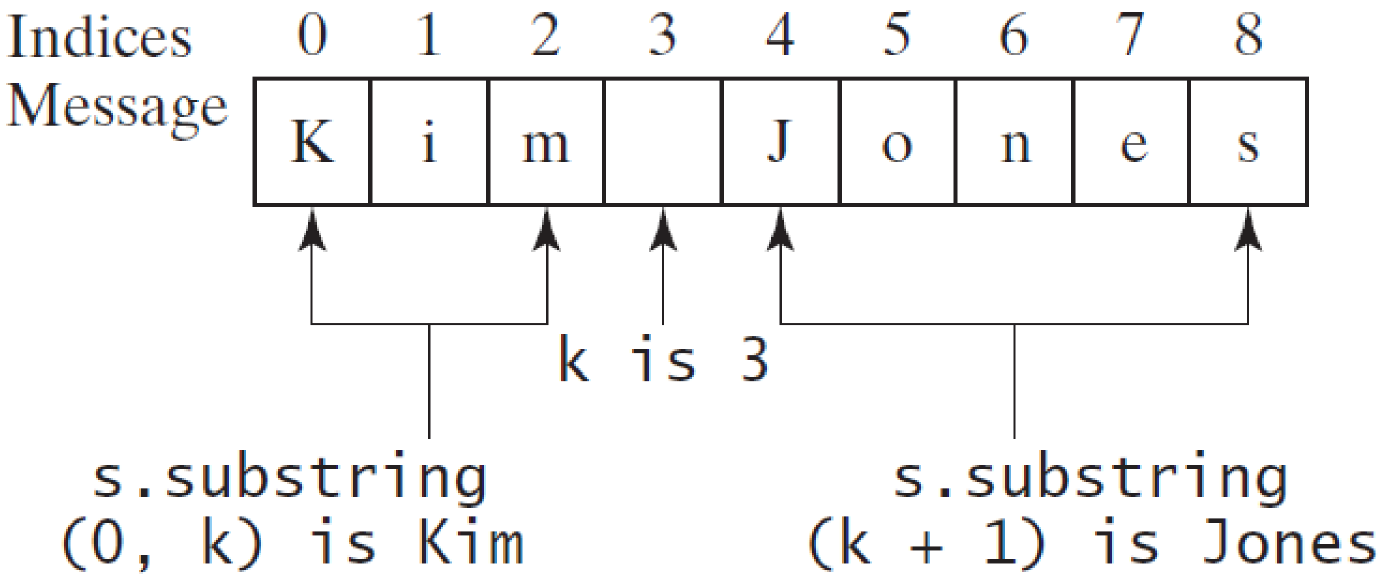


Finding a Character or a Substring

Method	Description
`indexOf(ch)`	Returns the index of the first occurrence of `ch` in the string. Returns `-1` if not matched.
`indexOf(ch, fromIndex)`	Returns the index of the first occurrence of `ch` after `fromIndex` in the string. Returns `-1` if not matched.
`indexOf(s)`	Returns the index of the first occurrence of string `s` in this string. Returns `-1` if not matched.
`indexOf(s, fromIndex)`	Returns the index of the first occurrence of string `s` in this string after `fromIndex`. Returns `-1` if not matched.
`lastIndexOf(ch)`	Returns the index of the last occurrence of `ch` in the string. Returns `-1` if not matched.
`lastIndexOf(ch, fromIndex)`	Returns the index of the last occurrence of `ch` before `fromIndex` in this string. Returns `-1` if not matched.
`lastIndexOf(s)`	Returns the index of the last occurrence of string `s`. Returns `-1` if not matched.
`lastIndexOf(s, fromIndex)`	Returns the index of the last occurrence of string `s` before `fromIndex`. Returns `-1` if not matched.

Examples of Finding Characters and Substrings

```
int k = s.indexOf(' ');
String firstName = s.substring(0, k);
String lastName = s.substring(k + 1);
```



Conversion between Strings and Numbers

- Examples

```
int intValue = Integer.parseInt(intString);

double doubleValue = Double.parseDouble(doubleString);


String s = number + "";
```

Questions?